

Preliminary Inventory of Sources of Persistent Organic Pollutants in St. Petersburg

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Goal and Scope. The largest industrial city in the Northeastern part of Europe, St. Petersburg in Russia with its 4.9 million population, has a strong anthropogenic impact on the environment. The problem of health risk from environmental contamination by persistent organic pollutants (POPs), such as dioxins and poly-chlorinated biphenyls (PCBs), has the same magnitude as in other major Russian cities. Since 1997 a program of minimization of the risk has been under way in St. Petersburg. The main objectives of the present publication are: 1) to present the list of priority sources of emissions of dioxins and dioxin-like compounds; 2) to compare levels of PCBs and 2,3,7,8- tetrachlordibenzo-para-dioxin (TCDD) in soils of city territories; and 3) to demonstrate detection of PCBs as a consistent indicator of contamination by dioxins in soil and fish tissues as well as in human breast milk.

Methods. The data of GosSanEpidNadzor (State Committee of Sanitary and Hygiene Control) was the basis for creating the preliminary list of main sources of PCBs pollution. More than 300 samples of St. Petersburg's soil were collected and analyzed for PCBs by gas chromatography with an electron capture detector (GC/ECD). Forty samples of breast milk and 30 samples of fish tissues were analyzed by high resolution gas chromatography using Aroclor 1254 as an external standard. A special set of samples (presumed to be highly polluted samples of sludges, soils and incinerator ash) was analyzed for PCBs and also for TCDD by GC/HRMS.

Results and Conclusions. The preliminary list of sources of dioxin-like compounds in the environment (chemical enterprises using dioxin producing technologies, regions adjacent to the highways, storage of municipal and industrial waste, etc.) has been created. By monitoring the city territories, the specific sources of PCBs emissions were detected, and the map of PCBs environmental contamination was created as well. The results of analysis showed a consistent presence of 2,3,7,8-TCDD (1.7 - 7.2 ng/kg) - in soil samples with high PCBs concentrations (1500 - 11000 microgram/kg). Therefore, the monitoring of PCBs can serve as an important indicator of environmental contamination by dioxins. The evaluation of nursing mothers in the city population has revealed a relatively high concentration of PCBs in breast milk. The results for 40 samples of breast milk gave the following average concentrations: total PCBs (SPCB) at 327, total DDT (SDDT) at 410, total hexachlorocyclohexane (SHCCH) at 302 and hexachlorobenzene (HCB) at 133 microgram/kg fat. The role of trophic chains has been proposed. The results, indicating PCB accumulation in fish of different species from Ladoga Lake and Neva River, confirmed these assumptions. The levels of PCBs were determined and detected as 200-560 microgram/kg fat. In salmon the following levels of organo-chlorine compounds were found, depending on the place of fishing, age and sex of collected fish: SPCBs - 740-910 (muscle), 1300 (spawn), 1300 (milt); SDDT - 1900-2200, 3900 and 210, SHCCB - 53-76, 630, 351; HCB -51-54 and 250 microgram/kg of fat, respectively.

Recommendations and Outlook. Currently the special health risk cohorts has been compiled for a special biomedical monitoring with emphasis on detection of PCBs and dioxins in human tissues and food products. It is extremely important to conduct the quantitative risk assessment from POPs in the St. Petersburg city population using standardized international methods and protocols. This will be accomplished through collaboration with the specialists from Department of Environmental Health, School of Public Health, Harvard University, Boston.